

**Claims**

We claim:

- 1 1. A wireless communication system comprising:  
2 a plurality of transceiver antennae, each transceiver spatially separate from at least  
3 one other transceiver antenna, each transceiver antenna further comprising a transceiver  
4 antenna polarization, at least one transceiver antenna having a polarization that is  
5 different than at least one other transceiver antenna, each transceiver antenna transmitting  
6 a corresponding data stream;  
7 a plurality of receiver antennae, the receiver antennae receiving at least one data  
8 stream; wherein  
9 the transceiver antenna polarization of each transceiver antenna is pre-set to  
10 optimize separability of the received data streams.
- 1 2. The wireless communication system of claim 1, wherein the pre-set transceiver  
2 antenna polarization of each transceiver antenna is determined experimentally.
- 1 3. The wireless communication system of claim 2, wherein the pre-set transceiver  
2 antenna polarization of each transceiver antenna is experimentally determined by  
3 characterizing the separability of received data streams.
- 1 4. The wireless communication system of claim 2, wherein a transmission channel  
2 between the transceiver antennae and the receiver antennae is estimated with a channel  
3 matrix, and wherein the pre-set transceiver antenna polarization of each transceiver

4 antenna is experimentally determined by minimizing a singular value spread of the  
5 channel matrix.

1 5. The wireless communication system of claim 1, wherein each receiver antenna is  
2 spatially separate from at least one other receiver antenna, each receiver antenna further  
3 comprising a receiver antenna polarization, at least one receiver antenna having a  
4 polarization that is different than at least one other receiver antenna.

1 6. The wireless communication system of claim 1, further comprising a receiver that  
2 is connected to the receiver antenna, the receiver including electronic circuitry for  
3 estimating a channel matrix that represents a transmission channel between the  
4 transceiver antennae and the receiver antennae, the pre-set transceiver antenna  
5 polarization of each transceiver antenna being determined by minimizing a singular value  
6 spread of the channel matrix.

1 7. The wireless communication system of claim 5, wherein the receiver antenna  
2 polarization of each receiver antenna is pre-set to optimize separability of the received  
3 data streams.

1 8. The wireless communication system of claim 7, wherein the pre-set receiver  
2 antenna polarization of each receiver antenna is determined experimentally.

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1 9. The wireless communication system of claim 8, wherein a transmission channel  
2 between the transceiver antennae and the receiver antennae is estimated with a channel  
3 matrix, and wherein the pre-set receiver antenna polarization of each receiver antenna is  
4 experimentally determined by minimizing a singular value spread of the channel matrix.

1 10. The wireless communication system of claim 1, wherein the transceiver antenna  
2 polarization of each transceiver antenna is pre-set to minimize correlation between the  
3 data streams.

1 11. The wireless communication system of claim 10, wherein the pre-set transceiver  
2 antenna polarization of each transceiver antenna is determined experimentally.

1 12. The wireless communication system of claim 11, wherein a transmission channel  
2 between the transceiver antennae and the receiver antennae is estimated with a channel  
3 matrix, and wherein the pre-set transceiver antenna polarization of each transceiver  
4 antenna is experimentally determined by minimizing a correlation coefficient of the  
5 channel matrix.

1 13. The wireless communication system of claim 5, wherein the receiver antenna  
2 polarization of each receiver antenna is pre-set to minimize correlation between the data  
3 streams.

1 14. The wireless communication system of claim 13, wherein the pre-set receiver  
2 antenna polarization of each receiver antenna is determined experimentally.

1 15. The wireless communication system of claim 14, wherein a transmission channel  
2 between the transceiver antennae and the receiver antennae is estimated with a channel  
3 matrix, and wherein the pre-set receiver antenna polarization of each receiver antenna is  
4 experimentally determined by minimizing a correlation coefficient of the channel matrix.

1 16. The wireless communication system of claim 1, further comprising clusters of  
2 transceiver antennae, each cluster including a transmission channel, wherein the pre-set  
3 transceiver antenna polarization of each transceiver antenna is experimentally determined  
4 by minimizing co-channel interference between the clusters.

1 17. A wireless communication system comprising:  
2 a plurality of transceiver antennae, each transceiver spatially separate from at least  
3 one other transceiver antenna, each transceiver antenna further comprising a transceiver  
4 antenna polarization, at least one transceiver antenna having a polarization that is  
5 different than at least one other transceiver antenna, each transceiver antenna transmitting  
6 a corresponding data stream;  
7 a plurality of receiver antennae, the receiver antennae receiving at least one data  
8 stream; wherein

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9 the transceiver antenna polarization of each transceiver antenna is adaptively set  
10 to optimize separability of the received data streams base on channel parameters  
11 determined within a receiver connected to the receiver antennae.

1 18. The wireless communication system of claim 17, wherein the receiver includes  
2 electronic circuitry for estimating a channel matrix that represent a transmission channel  
3 between the transceiver antennae and the receiver antennae, the transceiver antenna  
4 polarization of each transceiver antenna being adaptively set by minimizing a singular  
5 value spread of the channel matrix.

1 19. A method of wirelessly communicating between a transceiver and a receiver  
2 within a wireless communication system, the communication system comprising the  
3 transceiver, the transceiver comprising a plurality of transceiver antennae, each  
4 transceiver spatially separate from at least one other transceiver antenna, each transceiver  
5 antenna further comprising a transceiver antenna polarization, at least one transceiver  
6 antenna having a polarization that is different than at least one other transceiver antenna,  
7 the communication system further comprising the receiver, the receiver comprising a  
8 plurality of receiver antennae, the method comprising:  
9 each transceiver antenna transmitting a corresponding data stream;  
10 the receiver antennae receiving at least one data stream;  
11 electronic circuitry within the receiver estimating a channel matrix that represents  
12 a transmission channel between the transceiver antennae and the receiver antennae; and

- 13           pre-setting the transceiver antenna polarization of each transceiver antenna by  
14   minimizing a singular value spread of the channel matrix.

1   20.    The method of wirelessly communicating between a transceiver and a receiver  
2   within a wireless communication system of claim 19, wherein each receiver antenna is  
3   spatially separate from at least one other receiver antenna, each receiver antenna further  
4   comprising a receiver antenna polarization, at least one receiver antenna having a  
5   polarization that is different than at least one other receiver antenna, the method further  
6   comprising:

7           pre-setting the receiver antenna polarization of each receiver antenna by  
8   minimizing a singular value spread of the channel matrix.

1   21.    The method of wirelessly communicating between a transceiver and a receiver  
2   within a wireless communication system of claim 19, the method comprising:  
3           pre-setting the transceiver antenna polarization of each transceiver antenna to  
4   minimize correlation between the data streams.

1   22.    The method of wirelessly communicating between a transceiver and a receiver  
2   within a wireless communication system of claim 20, the method comprising:  
3           pre-setting the receiver antenna polarization of each receiver antenna to minimize  
4   correlation between the data streams.

1 23. A wireless communication system comprising:  
2 a plurality of transceiver antennae, each transceiver spatially separate from at least  
3 one other transceiver antenna, each transceiver antenna further comprising a transceiver  
4 antenna polarization, at least one transceiver antenna having a polarization that is  
5 different than at least one other transceiver antenna, each transceiver antenna transmitting  
6 a corresponding data stream;  
7 a plurality of receiver antennae, the receiver antennae receiving at least one data  
8 stream; and  
9 means for setting the transceiver antenna polarization of each transceiver antenna  
10 to optimize separability of the received data streams.

1 24. The wireless communication system of claim 23, wherein a transmission channel  
2 between the transceiver antennae and the receiver antennae is estimated with a channel  
3 matrix, and wherein the means for setting the transceiver antenna polarization of each  
4 transceiver antenna is responsive to minimizing a singular value spread of the channel  
5 matrix.

1 25. The wireless communication system of claim 23, wherein each receiver antenna is  
2 spatially separate from at least one other receiver antenna, each receiver antenna further  
3 comprising a receiver antenna polarization, at least one receiver antenna having a  
4 polarization that is different than at least one other receiver antenna.

1 26. The wireless communication system of claim 23, further comprising a receiver  
2 that is connected to the receiver antennae, the receiver including electronic circuitry for  
3 estimating a channel matrix that represents a transmission channel between the  
4 transceiver antennae and the receiver antennae, wherein the means for setting the  
5 transceiver antenna polarization of each transceiver antenna is responsive to minimizing a  
6 singular value spread of the channel matrix.

1 27. The wireless communication system of claim 25, further comprising means for  
2 setting the receiver antenna polarization of each receiver antenna to optimize separability  
3 of the received data streams.

1 28. The wireless communication system of claim 27, wherein a transmission channel  
2 between the transceiver antennae and the receiver antennae is estimated with a channel  
3 matrix, and wherein the means for setting the receiver antenna polarization of each  
4 receiver antenna comprises minimizing a singular value spread of the channel matrix.

1 29. The wireless communication system of claim 25, further comprising means for  
2 setting the receiver antenna polarization of each receiver antenna to optimize de-  
3 correlation of the received data streams.

1 30. The wireless communication system of claim 29, wherein a transmission channel  
2 between the transceiver antennae and the receiver antennae is estimated with a channel



1 31. The wireless communication system of claim 1, wherein the pre-set transceiver  
2 antenna polarization of each transceiver antenna is determined experimentally.

# ESSENTIALS